501,036

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 July 2003 (17.07.2003)

PCT

(10) International Publication Number
WO 03/057418 A1

(51) International Patent Classification[7]: B25G 1/01

(21) International Application Number: PCT/EP02/14469

(22) International Filing Date:
18 December 2002 (18.12.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
MI2002A000010 8 January 2002 (08.01.2002) IT

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:
— *of inventorship (Rule 4.17(iv)) for US only*

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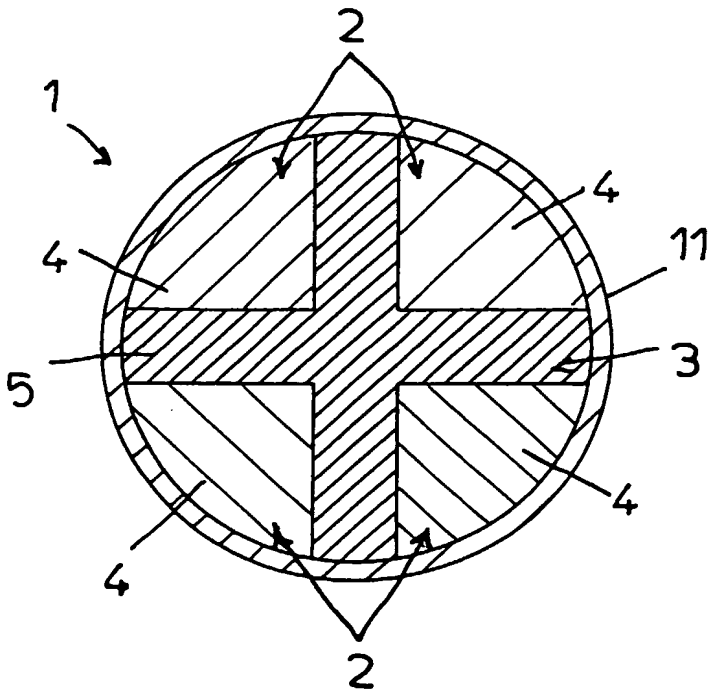
(54) Title: ELEMENT WITH VERY HIGH MECHANICAL RESISTANCE AND HIGH VIBRATION ABSORPTION AND METHOD FOR IMPLEMENTING THE SAME



(57) Abstract: Element (1) with very high mechanical resistance and high vibration absorption, comprising at least one internal core (20) composed of at least one first material (2) having predominantly high mechanical characteristics, and united, through chemical bonding only, with at least one second material having predominantly highly elastic characteristics; the embodiment method consists in automatically uniting through chemical bonding a first material with predominantly high mechanical characteristics with at least a second material (3) with predominantly highly elastic characteristics in order to form a core (20) to be coated with at least a third material (11).

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ELEMENT WITH VERY HIGH MECHANICAL RESISTANCE AND HIGH VIBRATION ABSORPTION AND METHOD FOR IMPLEMENTING THE SAME

DESCRIPTION

The present invention refers to an element with high mechanical resistance and high vibration absorption, and to a method for implementing the same.

In particular, the element according to the present finding may not necessarily be used preferably for handles on tools such as hammers, sledge hammers, tools used for buffeting trees for fruit-picking, axes, and the like, but also for manufacturing any structures that require high mechanical and workability characteristics and high vibration absorption characteristics at the same time, combined with special physical properties such as resistance against corrosion, absence of hygroscopy and porosity, shrinking and dilatation.

It is a well known fact that elements that must be held in the hand for use, such as handles and the like, that possess mechanical resistance, and that are able to absorb vibration, are traditionally manufactured in wood to guarantee considerable technological performance because of its fibrous nature (splitting and cutting capacity, flexibility, cleanliness and plasticity levels) combined with physiological properties (porosity, density, hygroscopy, homogeneity, shrinking and dilatation) and good vibration absorption.

However, in certain cases the mechanical properties of

wood (traction, compression, bending, cutting capacity, torsion) result as insufficient for certain applications, for example when the predominant stress involves strong impact (impact stress) or flexion.

In these cases, results have shown that the wooden element used as a handle in a wide variety of work sectors can break because of its morphology.

Moreover, with wear, wood can splinter harming the user, and when subject to atmospheric agents (for example, when left outside) because it is hygroscopic it tends to shrink or dilate thus provoking play between the wooden element and the other elements attached to it that are generally made of metal.

To overcome these problems, other types of handle have been manufactured with fibreglass-reinforced plastic core that acts as a coating and to provide a correct grip.

However, these solutions have also created many problems, mainly due to the fact that the fibreglass core transmits the vibrations provoked by tool use, and the vibrations are transmitted to the user's arm, almost without any cushioning, provoking consequential damage to the arm.

Moreover, when fibreglass is used for handles and the like, special adhesives must be used to create correct bonding between the various components and this leads to a considerable extension of production time, the need for more labour, and an increase in production costs, as well as the fact that all adhesives have varying aging times which

US-A-5588343 AND US-A-4336563 DISCLOSE AN ELEMENT ACCORDING TO THE PREAMBLE OF CLAIM 1 - (*)

influence the chemical and physical characteristics.

The use of adhesives can be eliminated, but this provokes long preparation times of the mould in which the various components are arranged.

This situation has a considerable influence on production costs, and produces unacceptable quality levels (*)(*). Therefore the technical objective proposed in this invention is to create an element with very high mechanical resistance, and high vibration absorption, and a method for implementing the same, which eliminate the technical problems encountered in prior art.

Within the context of this technical objective, one of the purposes of this invention is that of creating an element that, as well as producing excellent chemical and physical characteristics, is also able to cushion the vibrations that are generated during use, very efficiently.

Another purpose of the invention is to create an element and a method for producing said element without the need for specialized labour, and that can be manufactured in a short time and using automated production methods.

A further purpose of the invention is that of creating an element that is extremely reliable because of its long-lasting physical and chemical characteristics that can be designed so that it is not subject to degeneration because of the inevitable deterioration of some of its components, such as the adhesive.

The last, but by no means the least purpose of the

invention is that of creating an element and a production method that are basically economical, and that can be performed using a pultrusion method that is basically automatic.

The technical objective, as well as this and other purposes, according to the present invention are attained by providing an element with high mechanical resistance and high vibration absorption, ~~characterized in that it comprises at~~ ACCORDING TO CLAIM 1. least one internal core composed of at ~~least~~ one first material with predominantly very ~~high~~ mechanical resistance, combined through ~~chemical~~ bonding only with at least one second ~~material~~ with predominantly very highly elastic ~~characteristics.~~

The present finding also refers to a method for producing an element with very high mechanical resistance and high vibration absorption levels, ~~characterized in that it~~ ACCORDING TO CLAIM 9. consists of the automatic uniting through chemical ~~bonding~~, of a first material with predominantly ~~very~~ high mechanical resistance, combined with at ~~least~~ one second material with predominantly very ~~highly~~ elastic characteristics, in order to form a ~~core~~ that can be coated with at least one third ~~material.~~

Moreover, other characteristics of this invention are described in the depending claims.

Further characteristics and advantages of the invention will be more evident from the description of preferred but not limiting embodiment of the element with high mechanical

resistance and high vibration absorption and the method for implementing the same according to the finding, where the element is illustrated in an exemplificative but by no means limitative manner, in the enclosed drawings, in which:

- Figure 1 shows a cross section of an element defined as a handle according to the finding, and, shown in dotted lines, a tool which in this case purely as an example, is shown as the head of a hammer; and

- Figures 2 and 3 that show respectively in cross section and in prospective, a different embodiment of the element shown in figure 1.

With reference to the above-mentioned figures, the illustrated element with high mechanical resistance and high vibration absorption is identified in all drawings with the reference numeral 1.

Element 1, which, as has been stated above, can preferably be an element used as a handle for certain tools, or used for buffeting plants or the like, comprises at least one internal core 20, composed of at least one first material 2 with predominantly very high mechanical resistance, combined through chemical bonding only, and without the use of adhesives with at least one second material 3, with predominantly very highly elastic characteristics.

In particular, the structure of a tool handle will be described hereinbelow as a preferred but non limiting embodiment, taking into account, as has been previously stated, that any element that requires the above-mentioned

chemical and physical characteristics can also be produced for other uses.

In the case of a tool handle for example, the first material 2 is used to form two or more rod-shaped elements 4 that are substantially the same length as the handle to be manufactured.

The second material 3 is inserted between these rod-shaped elements as will be further described below, to form a real cushion 5 to absorb vibrations that tend to be transmitted along the two rod-shaped elements when the handle is subjected to impact involved during tool use.

Advantageously, the core 20, is obtained by simply combining the first material 2 with the second material 3 through chemical bonding obtained with the application of heat at an established temperature and without the use of adhesives between the first and second material, or through the use of an adhesive in the case of adhesion incompatibility between the two materials.

This simplifies and speeds up the creation of the core 20, and also permits the creation without the need for specialized labour for the production preparation, providing considerable advantages because of the large reduction in cost and time.

Suitably the first material (such as TPV, PP, PET) is made of a thermoplastic resin in which a plurality of natural or synthetic fibers are sunk (e.g. glass fiber), and the second material is made of an elastomeric polymer such as

thermoplastic polyurethane.

As an example, the first material can be an engineered polyurethane thermoplastic polymer, industrially recognized under the name ETPU (engineering thermoplastic polyurethane) and the second material comprises an elastomeric polymer, preferably polyurethane type.

Element 1 can also be coated over the core 20, with a covering layer 6, made of an elastomeric polymer.

Advantageously, the rod-shaped elements 4, are produced using a pultrusion method.

A coestrusion head is used to combine in a linear and continuous manner the two rod-shaped elements 4, produced with pultrusion, with the second material 3, to form the cushioning element 5.

For example, the coating layer 6, made of the third material composed of an elastomeric polymer can be applied onto the core 20 by a second coestrusion head.

In the case of handles shaped differently from the cylindrical form, for example ergonomically shaped handles, the third material in elastomeric plastic 6, can undergo a thermoforming stage.

In a constructive variant, the chemical bonding between the first and second material can be performed directly during the impregnation stage of the glass fiber with the thermoplastic resin.

In the case illustrated in figure 1, each of the rod-shaped elements 4, has a flat surface 10, and a curved

surface 11.

This means that the cushion 5, made from the second material, can be inserted between the two flat surfaces 10.

With this solution, during strong impact the main flexion in the handle will occur along the two flat surfaces 10 that will form a sliding movement between both elements due to the elasticity of the cushion inserted between the two flat surfaces.

At the same time, the vibrations will be cushioned and will not be able to spread along the handle.

In the case illustrated in figure 2, the rod-shaped elements are four in number, and a cross-shaped bearing made from the second material is inserted therebetween.

In this case flexion can occur around all 360° and vibration cushioning will be excellent.

Naturally the configuration of the rod-shaped elements can be of any type according to necessity.

For example, in certain cases the rod-shaped elements could be disks or the like.

The operation of the element with high mechanical resistance and high vibration absorption described in this invention is evident from the descriptions and illustrations.

For example, figure 1 represents the head of a hammer in dotted lines and is identified by the reference numeral 15.

When a hammer is used to hit with strong impact, the rod-shaped elements tend to transmit vibrations that are absorbed by the bearing 5, and coating 11.

Moreover, a slight sliding motion is created between the two rod-shaped elements in order to absorb impact further.

The present finding also refers to a method for the realization of an element with high mechanical resistance and high vibration absorption.

The method consists in the automated union without the use of adhesives, of a first material with predominantly high mechanical characteristics with at least one second material with predominantly highly elastic characteristics.

In particular, advantageously, this union is created through chemical bonding that is performed with the application of heat at an established temperature.

In a constructive variant, in the case where the first and second materials are reciprocally incompatible for bonding adhesion, they can be glued together with a chemical bonding adhesive.

In this way a core is formed, that may be eventually coated with at least one third material.

Advantageously, the first material is created using a thermoplastic resin in which a plurality of natural or synthetic fibers are sunk (for example, glass fiber), and the second material is created using an elastomeric polymer, such as thermoplastic polyurethane.

As an example, the first material can be an engineered polyurethane thermoplastic polymer, industrially recognized under the name ETPU (engineering thermoplastic polyurethane) and the second material comprises an elastomeric polymer,

preferably polyurethane type.

The coating layer is made of an elastomeric polymer.

Advantageously, the rod-shaped elements 4, are created using a pultrusion method.

The two rod-shaped elements 4, created using pultrusion are united in a linear and continuous manner with the second material 3, which will form the bearing 5, using a coextrusion head, while if necessary, a second coextrusion head can be used to apply the third coating material.

In the case of ergonomically shaped handles, the application of the third elastomeric plastic material may be followed by a thermoforming stage.

In an constructive variant the chemical bond between the first and second material can be created during the impregnation of the glass fibers in the thermoplastic resin. Moreover, it is possible to insert the core 20, directly inside one of the moulds to obtain, for example, a handle for a tool molded in thermoplastic material with various materials for adhesion to the composite core created according to the invention.

It has been established that the element with high mechanical resistance and high vibration absorption, and the method for implementing the same according to the invention result as being particularly advantageous, because the element is able to absorb vibrations very efficiently and the production method is rapid and does not require specialized labour, thus being very cost-effective.

The element with high mechanical resistance and high vibration absorption, and the method for implementing the same according to the invention can be produced with numerous variants and modifications, all of which are included within the scope of the invention; moreover, all components can be replaced by elements that are technically equivalent.

CLAIMS

~~1. Element with high mechanical resistance and high vibration~~ absorption, characterized in that it comprises at least one internal core composed of at least one first material having predominantly high mechanical characteristics, united simply through chemical bonding, to at least a second material with predominantly highly elastic characteristics.

2. Element according to claim 1, characterized in that said first and second materials are bonded without the use of adhesives.

3. Element according to one or more of the preceding claims characterized in that said first material is composed of a thermoplastic resin in which a plurality of natural and/or ~~synthetic fibers are sunk~~.

2~~4~~. Element according to ~~one or more of~~ the preceding claims characterized in that said synthetic fibers are composed of glass fiber.

3~~5~~. Element according to one or more of the preceding claims characterized in that said second material (3) is composed of an elastomeric polymer.

4~~6~~. Element according to one or more of the preceding claims characterized in that said thermoplastic resin is an engineered polyurethane thermoplastic polymer, industrially recognised under the name ETPU (engineering thermoplastic polyurethane)

5~~7~~. Element according to one or more of the preceding claims characterized in that said second material (3) is composed of

AMENDED SHEET

~~thermoplastic polyurethane.~~

8. Element according to one or more ~~of the~~ preceding claims characterized in ~~that~~ the core is covered with a layer in a ~~third material composed of an elastomeric polymer.~~

~~9. Element according to one or more of the preceding claims~~ characterized in that said core (20) comprises at least two discrete (4) elongated elements (4) of said first material created using pultrusion AND EXTENDING ALONG THE ENTIRE LENGTH OF SAID ELEMENT WITH HIGH MECHANICAL RESISTANCE, AND

~~10. Element according to one or more of the preceding claims characterized in that said elongated elements are rod shaped or disk shaped.~~

~~11. Element according to one or more of the preceding claims characterized~~ in that a bearing (5) made of said second material (3) is inserted between said elongated elements.

~~12. Element according to one or more of the preceding claims~~ characterized in that said rod-shaped elements have at least one flat surface and one curved surface, said bearing being inserted between said flat surfaces of said adjacent rod-shaped elements.

13. Method for implementing an element with high mechanical resistance and high vibration absorption, characterized in that it comprises the automatic union through chemical bonding of a first material having predominantly high mechanical characteristics, with at least a second material having predominantly highly elastic characteristics, in order to form a core to be coated with at least one third material.

14. Method according to the preceding claim characterized in ~~fact that the union between the first and second material~~

thermoplastic polyurethane.

6/8. Element according to one or more of the preceding claims characterized in that the core (20) is covered with a layer (6) in a third material composed of an elastomeric polymer.

~~9. Element according to one or more of the preceding claims characterized in that said core comprises at least two elongated elements created using pultrusion.~~

7/10. Element according to one or more of the preceding claims characterized in that said elongated elements (4) are rod-shaped or disk-shaped.

~~11. Element according to one or more of the preceding claims characterized in that a bearing made of said second material is inserted between said elongated elements.~~

8/12. Element according to one or more of the preceding claims characterized in that said rod-shaped elements (4) have at least one flat surface (10) and one curved surface (11), said bearing (5) being inserted between said flat surfaces (10) of said adjacent rod-shaped elements (4).

9/13. Method for implementing an element (1) with high mechanical resistance and high vibration absorption, characterized in that it comprises the automatic union (4) through chemical bonding of a first material AND MADE OF (2) having predominantly high mechanical characteristics, with at least a second material A BEARING MADE OF (3) having predominantly highly elastic characteristics, in order to form a core to be coated with at least one third material.

AT LEAST TWO DISCRETE ELONGATED ELEMENTS (4) EXTENING ALONG THE ENTIRE LENGTH OF SAID ELEMENT WITH HIGH MECHANICAL RESISTANCE

10/14. Method according to the preceding claim characterized in fact that the union between the first (2) and second (3) material

NEW CLAIMS

1. Element (1) with high mechanical resistance and high vibration absorption, ~~characterized in that it~~ comprises (INC) at least one internal core (20) composed of at least one first material (2) having predominantly high mechanical characteristics, united simply through chemical bonding (3), to at least a second material with predominantly highly elastic characteristics,

~~2. Element according to claim 1, characterized in that~~ said first and second materials ~~are~~ (BEING) bonded without the use of adhesives,

~~3. Element according to one or more of the preceding claims characterized in that~~ said first material (2) ~~is~~ (BEING) composed of a thermoplastic resin in which a plurality of natural and/or synthetic fibers are sunk,

~~4. Element according to one or more of the preceding claims~~ characterized in that said synthetic fibers are composed of glass fiber.

5. Element according to one or more of the preceding claims characterized in that said second material is composed of an elastomeric polymer.

6. Element according to one or more of the preceding claims characterized in that said thermoplastic resin is an engineered polyurethane thermoplastic polymer, industrially recognised under the name ETPU (engineering thermoplastic polyurethane)

7. Element according to one or more of the preceding claims ~~characterized in that said second material is composed of~~

occurs without the use of an adhesive, but with the application of heat at an established temperature.

11 15. Method according to one or more of the preceding claims characterized in that said first material (2) is composed of a thermoplastic resin in which a plurality of natural and/or synthetic fibers are sunk.

12 16. Method according to one or more of the preceding claims characterized in that said synthetic fibers are composed of glass fiber.

13 17. Method according to one or more of the preceding claims characterized in that said second material (3) is composed of thermoplastic polyurethane.

14 18. Method according to one or more of the preceding claims characterized in that said thermoplastic resin is an engineered polyurethane thermoplastic polymer, industrially recognised under the name ETPU (engineering thermoplastic polyurethane)

15 19. Method according to one or more of the preceding claims characterized in that second material (3) is composed of an elastomeric polymer, preferably of polyurethane type.

16 20. Method according to one or more of the preceding claims characterized in that said third material is composed of an elastomeric polymer.

17 21. Method according to one or more of the preceding claims characterized in that said method includes at least one stage in which said first material (2) is obtained through pultrusion.

18 22. Method according to one or more of the preceding claims

characterized in that method includes at least one coextrusion stage at an established temperature to unite said first material (2) with said second material (3).

19 23. Method according to one or more of the preceding claims characterized in that said method includes a thermoforming stage to model said third material into an ergonomical shape.

20 ~~24. Element with high mechanical resistance and high~~ vibration absorption and the method ~~for~~ implementing the same, as described, claimed and represented in the enclosed ~~drawing tables.~~

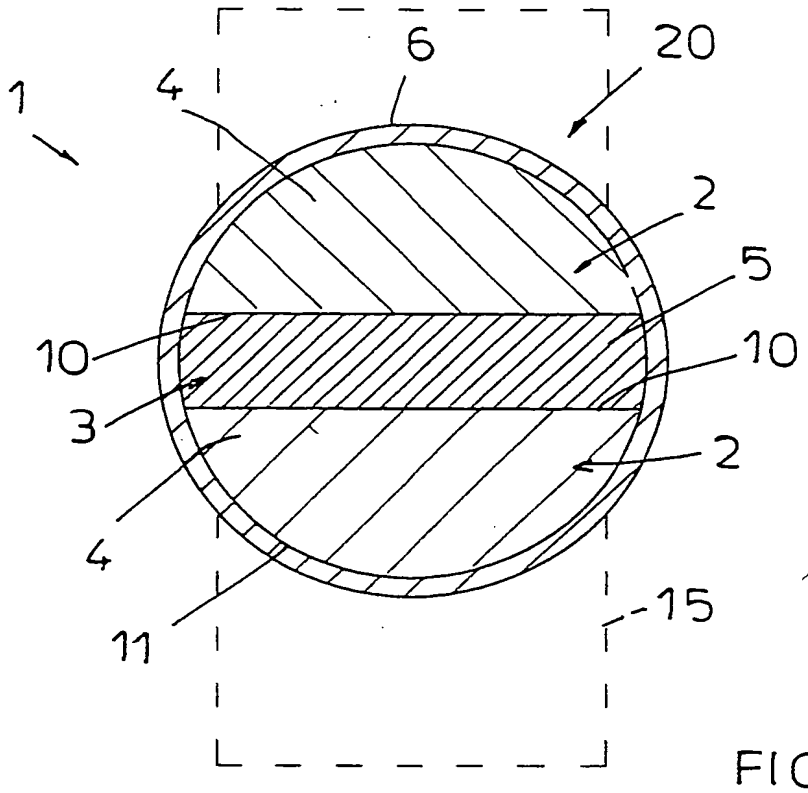

FIG 1

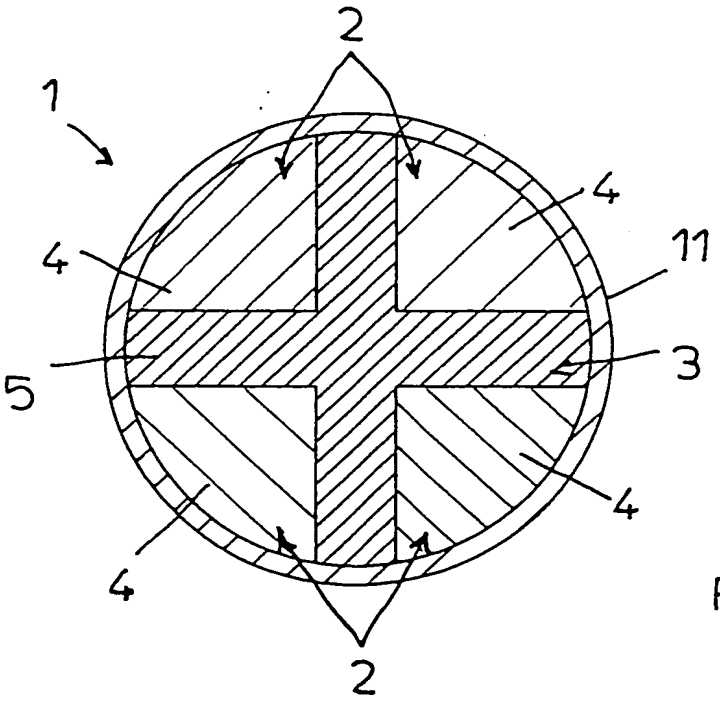

FIG 2

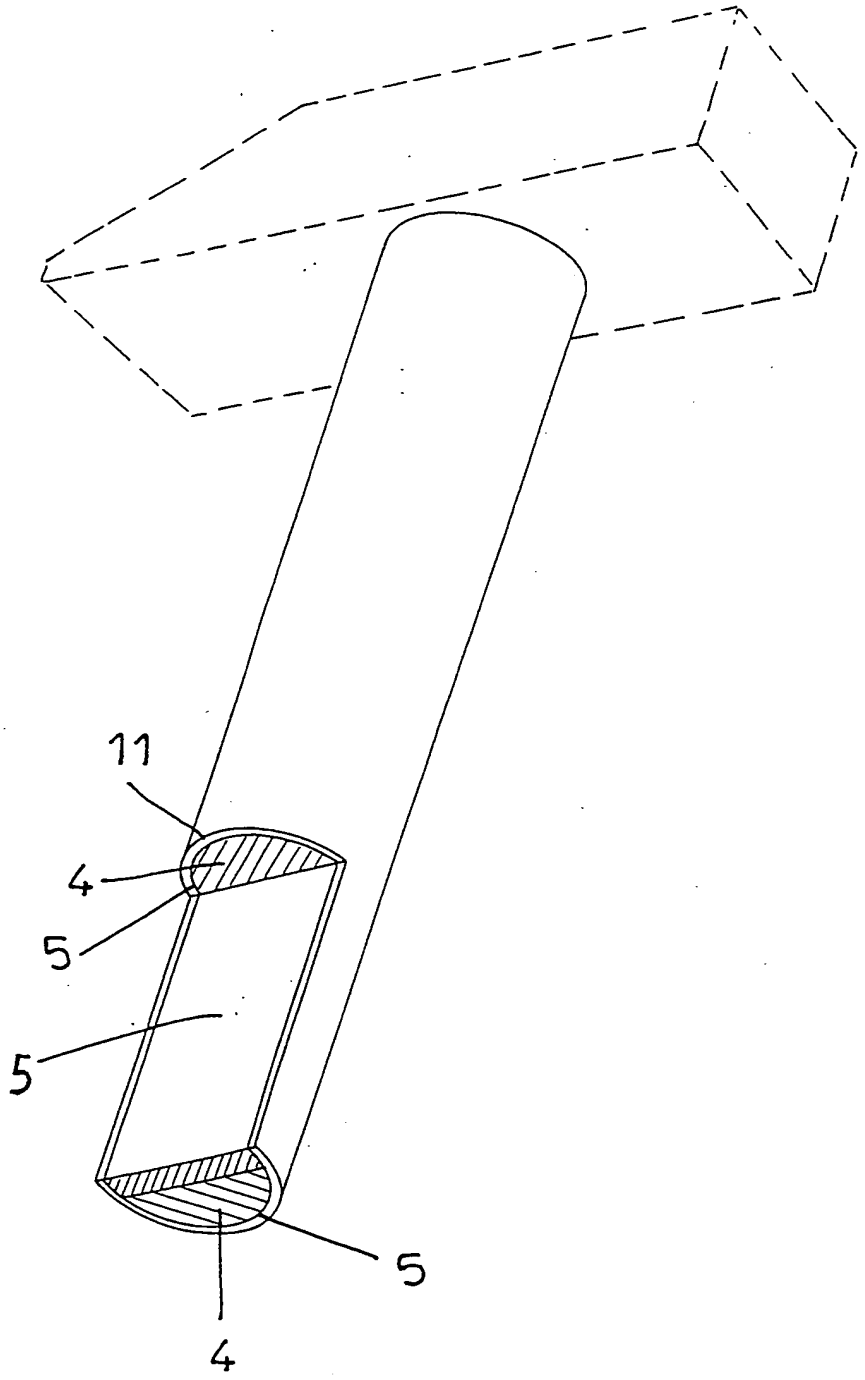

FIG 3